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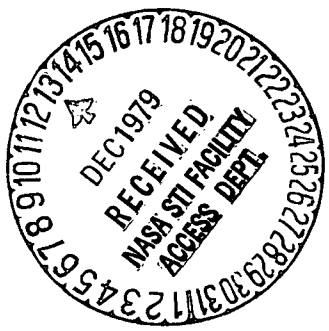

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STUDY FINDS RISK "INSIGNIFICANT" WITH CARBON FIBER USE

A 22-month U.S. government/industry study has determined that the risk of electrical equipment damage from release of carbon fibers from a civil aircraft accident is insignificant.

Results from the NASA analysis were reported this week at a conference at NASA's Langley Research Center, Hampton, Va.

At the same meeting, representatives of several government agencies and private companies presented technical papers and oral reports on various aspects of continuing government study of the potential use of carbon fibers.

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R. R. Heldenfels, Langley's Director for Structures, summarized the NASA study results by saying the public risk from using carbon fibers on current and future civil aircraft in the United States is so small as to be insignificant.

Carbon or graphite fibers are small-diameter filaments used to make composite materials. Composites are formed when fibers are embedded in a plastic matrix to form a solid material. Composites are being used increasingly in aircraft because of their high strength, durability, improved performance factors and lighter weight.

Composites are also used in many commercial products, from recreation to industrial equipment. With a growing demand for composites, the government became concerned about potential accidental release of the fibers. The perceived potential risk stems from the reaction of most composite structures to burning, which causes the composites to break down, releasing short lengths of fibers into the atmosphere. Considered to be highly heat-resistant and electrically conductive, the released fibers were first thought to be very damaging to electrical equipment. Because of their extreme lightness, fibers can possibly float for miles, settle on electrical equipment and sometimes cause short circuits or equipment malfunctions.

"The study had to be done," says Robert Huston of Langley, Manager of the NASA Graphite Fibers Risk Analysis portion of the government study. "If the earlier concern had materialized, there was a good chance that carbon fiber applications throughout the country would have been seriously impacted."

In July 1977, the Director of the Office of Science and Technology Policy was directed by the President to conduct a study of carbon composite materials analyzing the potential problems and providing a plan for possible federal action.

Preliminary analysis of the situation determined that the greatest potential for release was either during manufacture of composite materials or when carbon composites were burned. In the government-wide study of the issue, reporting to the Office of Science and Technology Policy, NASA was assigned to the specific task of assessing the risks in the civil aviation field.

A Graphite Fibers Risk Analysis Program Office was established at Langley, supported by NASA's Ames Research Center, Mountain View, Calif.; Johnson Space Center, Houston; and Jet Propulsion Laboratory, Pasadena, Calif.

Valuable support of the NASA study was provided by the National Bureau of Standards, several Department of Defense laboratories and private aerospace and research companies.

Other government agencies involved in various aspects of the total government study include the Departments of Commerce, Transportation, Energy and the Environmental Protection Agency. Their representatives also reported on the status of their research at the Langley conference.

An example of the kind of research conducted during the NASA study was a test series at the U.S. Army's Dugway Proving Ground in Utah. Begun in the fall of 1979, the tests were meticulously designed to recreate an aircraft fuel fire. Actual composite parts were burned with jet aircraft fuel for 20-minute periods, the length of the average aircraft fire.

A test apparatus called a Jacob's Ladder was devised to determine the rate of release of carbon fibers from a composite burn site. A Jacob's Ladder is a giant, movable net -- 305 meters (1,000 feet) square -- vertically suspended in the air by large balloons and guy wires. The device was located 152 m (500 ft.) downwind of the burn site.

More than 500 sampling instruments were installed on the Jacob's Ladder. Another 1,600 ground samplers were scattered around the burn area to a distance of 23 kilometers (14 miles). The most complex samplers, located on the net, were eight high-voltage grids that counted each fiber's contact with the electrical field and measured the electrical resistance of the fibers. This allowed researchers to obtain a constant readout on the flow rate and the characteristics of the fibers.

The most important conclusion from five burn tests at Dugway was confirmation of the earlier laboratory tests that showed less than 1 percent of the fibers are released in a typical aircraft crash fire.

A small percentage of the epoxy matrix in the composites was converted under heat to a carbon char, which bound masses of fibers together, keeping them from drifting with the smoke plume. Between 50 and 70 percent of the fibers in the composite material remained because of the carbon char binding. Substantial portions of the remaining fibers were burned away.

Detailed analysis by Langley researchers of information on electrical equipment revealed these additional facts:

- Many kinds of commercial electrical equipment have conformal coating on the circuit boards, insulating the equipment from carbon fiber shorting. (Conformal coating is a process in which circuits are dipped in an epoxy-like substance that makes them virtually fail-safe against short circuits.)

- Most companies that have critical computer controls routinely place the equipment in highly filtered and air-conditioned rooms that in addition provide protection from penetration by carbon fibers.

- Airborne carbon fibers released by burning of aircraft composite components do not present a significant risk to industrial equipment, television sets and stereo equipment.

- Common 110-volt motors and household appliances are largely invulnerable to carbon fibers.

Research further discovered that fiber-induced malfunctions in some equipment could be corrected merely by using a vacuum cleaner to remove the fibers.

After almost two years of research, NASA results indicate that the risk of using carbon fiber composites in civil aircraft is insignificant. The loss to the U.S. economy -- by the early 1990s -- of the accidental release of fibers from aircraft crash fires is expected to be approximately $1,000 a year.

The expected loss is far exceeded by the benefits to the nation from reduced fuel usage by aircraft built with carbon fiber composites.

"We have collected the requisite data, made appropriate analyses and conclude that the risk is so small that it would not deter the use of carbon composites in civil aircraft," Heldenfels stated.

Reports presented at the conference will be compiled and published in March 1980.

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